ADDRESSING THE ISSUE OF TRUST IN ELEMENTARY TEACHERS' MATHS-SPECIFIC EDUCATION: ANFOMAM PROJECT

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Abstract

To improve primary school teachers' maths-specific education at university, our project will develop a series of workshops, as ready-to-use instruments, which closely consider children's way of learning and their relationship with mathematics. Thus, the interest of participants in children is exploited in sessions which take into account both their

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professional work as teachers and their own childhood experiences. The aim is to help participants to evolve in the key aspect of trust. The paper describes the objectives and first results of the ANFoMAM project, supported by the Erasmus Plus Programme in the area of strategic partnerships for innovation in higher education in Europe.

Keywords: university mathematics education, pre-service mathematics education of primary teachers, in-service professional development of primary mathematics teachers, Trisomy 21, education of children with intellectual disabilities

Introduction

The ANFoMAM project takes its name from the Spanish version of its title, "Learning from children to improve Maths-specific primary teachers' education". The idea of ANFoMAM arose from the Symposium *Numeracy and Beyond* in the 5th International Congress of educational sciences and development (Santander and May 2017), when we interchanged different experiences stemming from work carried out to improve the training of both pre-service and in-service primary school teachers in mathematics in France, Italy, Norway and Spain (Celi and De Simone, 2018; Campión Arrastia et al, 2017; Lekaus et al., 2015).

In these countries, trainee teachers report a poor experience of maths courses in primary and secondary school that often includes feelings such as annoyance or distress together with a vision of mathematics reduced to pure calculation and mechanical procedures (Gil Clemente and Millán Gasca, 2016).

Avoiding the false debate between improving teachers' mathematical training or focusing on teaching didactical techniques, all the initiatives presented at the Congress in Santander pursued the common goal of providing teachers with both a deeper understanding of the basic concepts of mathematics and a knowledge of effective teaching resources for the classroom (Rico, Gómez and Cañadas, 2010).

As teachers in charge of elementary mathematics in further education, our common view was that it must be the university that provides these trainee teachers with new mathematical learning and teaching experiences, so that they can transmit to children confidence and enthusiasm to learn. But, what kind of course would be able to provide such experience to trainee teachers?

We agreed that a workshop format would be suitable for this purpose because it encourages a more active involvement of the participants in the activities than the ordinary classes. Consequently, the main goal of our project is to design didactical material for use in the above-mentioned format, to be offered both as complementary activities to standard university courses in mathematics and for updating in-service teachers (Catalán et. al, 2019).

The workshops will be inspired by the training interventions shown in Santander, which deal with different aspects of the learning of mathematics, all focussing on creating an adequate pedagogical environment. Much inspiration was drawn from the mathematical activities with children with Trisomy 21 designed in the

Sesdown association in Zaragoza (Spain) (Gil Clemente, 2016). These activities do not require any previously-acquired cognitive skills from children; on the contrary, mathematical activities are applied in order to develop children's abstract thinking and imagination, and to enhance their self-fulfillment and their relation with the world around them. We think that the way in which these children are learning maths can shed light on the way of learning maths of any child in general.

During the project, the mentioned workshops with Down Syndrome children will be recorded in videos, which will be part of the didactical material addressed to teachers at formation. In this way, teacher trainees will have the opportunity of watching a specific way of learning, in order to learn about maths learning in general. In this way, the diversity will be seen as an opportunity for growth for all the students.

The institutions associated with the project, which has been co-founded by the Erasmus + program of Strategic Partnership in the field of higher education, are: Université de Bordeaux (École supérieure du professorat et de l'éducation d'Aquitaine), France; Università Roma Tre (Department of Education), Italy; Universidad de Zaragoza, Universidad Pública de Navarra (Spain); Sesdown Association, which investigates on education of children with Trisomy 21 in Spain and Tokalon Association, working in the area of professional development of in-service teachers, in Italy. The coordinator is the Public University of Navarre in Pamplona, Spain.

ANFoMAM project

Goal of the project

Often, primary teachers have a bad relation with mathematics because of their own experience during childhood and secondary school (Margolinas, 2007). The goal of the project is, firstly, to know the beliefs and attitudes that both pre-service and in-service teachers have in relation to mathematics by means of six questionnaires, each of them designed for a specific aspect of the discipline: (i) Understanding of arithmetic algorithms; (ii) solving arithmetic problems; (iii) relationship between arithmetic and geometry; (iv) reasoned computation and use of the calculator; (v) history of mathematics and its teaching and (vi) geometric constructions and solving geometrical problems.

Then, we intend to design the didactical material necessary to implement six workshops (or *ateliers*) for training in each of the specific areas to both prospective and to in-service teachers.

Each of these workshops will be composed of several segments or sessions with a total duration of between ten and fifteen hours. In the case of pre-service teachers, the workshops will serve as a complement to standard university courses in mathematics. In addition, the six workshops will constitute a whole updating

course for in-service teachers. During the project, of three years' duration, the workshops will be implemented in a pilot phase with some regular groups of students of the associated institutions. So, the characteristics of the groups will be different at each of them, depending on its own organization.

Although each workshop will address a different aspect of children's maths education, all of them will share a same pedagogical frame. This frame, which must be better defined during the project, will take into account the following aspects:

1. A close sight at children's way of learning, analyzing not only their conceptual or procedural difficulties with maths but also which tasks make sense for them (Donaldson, 1987)
2. Search for a deeper understanding of the basic concepts (objects and relationships) in mathematics together with their roots in human experience (Millán Gasca, 2016)
3. A preference for relational learning before instrumental one (Skemp, 1976)
4. Promote active methodologies that encourage students' participation (Campión Arrastia et al., 2017)
5. A real consideration of the inclusion of children with special needs in the classroom (Gil Clemente and Millán Gasca, 2016)

Although the workshops are addressed to teachers at (initial or continued) formation, we intend that the designed activities can be easily translated to the school classrooms. In this way, participants will learn maths at the same time that they get practical resources to teach maths to children.

Methodology

The methodology of the workshops is inspired by research in the Laboratory of Mathematics for primary school at the Department of Education in Roma Tre University. The workshops will simulate a primary school classroom where adult activities are combined with the design of activities addressed to children. *Mimesis* (as in theatre and performance arts) is awakened as a pedagogical method (Scaramuzzo, 2016), following research in the MimesisLab (Laboratory on the Pedagogy of expression) in the above-mentioned Department of Education: Students will place themselves imaginatively at the children's point of view, which will help them to understand which tasks make human sense for them and which difficulties learning may present for children.

At the same time, students will learn to apply mimesis to the mathematics classroom at school, designing tasks that require children to act in ways which are in line with very basic human purposes and intentions, as suggested by Donaldson (1987). This kind of approach has already been used in the mathematical workshops that Sesdown Association carries out regularly with Trisomy 21 children (Millán Gasca and Colella, 2017) in which children may feel like if they were, for instance, tightrope walkers in a circus, to notice the characteristics of a straight line, or tiger tamers, to distinguish the inside of his hoop from the

hoop itself. These activities take advantage of children's capacity of understanding the whole situation, in order to make conscious thought emerge from their naïve conceptions.

The university students of teacher degrees that have participated as voluntaries in Sesdown workshops report a new perception of maths that are giving them a deeper understanding of the basic concepts (objects and relationships) in mathematics together with their roots in human experience (Gil Clemente, Millán Gasca, 2016). At the same time, the participation in the workshops is providing students with a lot of resources to teach mathematics with pleasure, strength and effectiveness. The project intend to extend this learning opportunity to pre-service and in-service teachers by recording Sesdown workshops in videos that will be included in the didactical material designed in the project. In this way, future teachers will have the opportunity of analysing them in order to acquire didactical resources to work not only with special needs children, but also with every child in an inclusive way.

Besides the analysis of the videos, some specific tasks will be designed for each workshop, sharing the aims described in Section 2.1:

i) *Understanding of arithmetic algorithms*. Activities will be designed to compute the four basic operations with material and graphic support in order to the understanding of algorithms linked to properties of numbers. At the same time, there will be an analysis of the convenience of choosing a particular algorithm and a specific support in each case.

ii) *Solving arithmetic problems*. We will design several mathematical situations that allow students to state arithmetical problems. The emphasis will be put on discovering and representing graphically implicit relationships between magnitudes. Different resolution strategies will be also analysed.

iii) *Relationship between arithmetic and geometry*. Design of situations that show natural connections between these two disciplines, such as repetition of equal elements, presented both in multiplication situations and in measurement problems; comparison of quantities that can be represented by using geometry; or composition and decomposition situations, occurring in measurement tasks.

iv) *Reasoned computation and use of the calculator*. Design of activities that show the mathematical knowledge underlying some calculus strategies together with tasks that improve the combined use of mental calculation and calculator for exploring numerical facts.

v) *History of mathematics and its teaching*. Reflection about the dynamical nature of maths for giving students a new perspective not only on mathematics but also on maths teaching, making them capable of analysing the way they have been taught and of finding grounds and resources to do it in another way in their professional activity.

vi) *Geometric constructions and solving geometrical problems*. Discovering of invariant properties of figures by movements, making geometrical constructions that cause surprise and aesthetical pleasure to students while help them in the building of the abstract geometrical space.

How to enhance students' trust

Donaldson describes the tasks proposed to encourage children to learn a certain discipline as those "the child will be able objectively to do well, but not too easily, not without putting forth some effort, not without difficulties to be mastered, errors to be overcome, creative solutions to be found" (Donaldson 1987, pp. 115). These kinds of activities, together with a sensitive and accurate response of the teacher to children's errors, will help them to acquire confidence and energy.

Translating these ideas to further education, these are the kind of tasks we intend to propose pre-service and in-service teachers during the workshops in order to give them the necessary trust[1] to teach maths in a pleasant and effective way.

During our experience as teachers at university, we have realized that, on a purely rational level, ordinary classes provide a lot of things that should help students to be teachers, such as a good understanding of basic mathematics or its implications in the maturation process of a child. In addition, the university professor, by means of their listening attitude and optimism, may transmit to students a feeling of confidence based on good arguments, tested experiences, efficacy evidences, etc.

But this is not enough! It is also necessary for both future and current teachers to acquire a feeling of *trust,* different from faith but deeper than confidence, more instinctive than rational, that we expect that workshops can provide. Covey and Merrill (2006), referring to professional success in general, write that "trust is the most overlooked, misunderstood, underutilized asset to enable performance. Its impact, for good or bad, is dramatic and pervasive."

In the context of education, Orón Semper and Blasco (2018) review the literature existing about the importance of the quality of the relationships between the teacher and the student even at university. Citing Portelli (1993, pp. 345), they say that a collaborative activity teaching requires trust and they demand teachers believe in the student's potential to create a relationship of trust and respect.

We expect that the workshops designed and implemented during the project provide students with new experiences that change their beliefs about the nature of maths and about their own capacity of learning it, making participants reconcile with their past, which is operating at an unconscious level.

For this purpose, it is necessary to design activities that lead to participants leaving the sessions with the idea that they will not fail in performance, or at least, they do not have a fear of failing because they are willing to take the risk of teaching; the result is worth it.

But this will only be possible if there is also an important change in the way that the workshop instructor looks at their students. Instead of focusing only on their knowledge of mathematics, the activities designed for the workshops must let the professor become a witness to their students' interest in children as well as their ability to teach them in an effective way.

Results

At the moment, the team has developed some questionnaires designed to detect some conflicting areas in the training of pre-service teachers, which will be the starting point for developing the six workshops planned.

Besides the workshops-related questionnaires, a general questionnaire about students' beliefs and attitudes has been given to pre-service and in-service teachers in France, Italy and Spain. An initial analysis of the results shows three different profiles among the students: a first group that shows a strong lack of motivation linked to a static conception of mathematics; a second one with an instrumental vision of the discipline, linked to effort and perseverance; and a motivated group of students with a dynamic vision of mathematics, as a subject that provides enjoyment and personal growth. This last position is more frequent among in-service teachers than among university students. Some differences also appear between countries, but further detailed analysis is necessary to specify what these are.

In a complementary way, the team's interest in the teaching of maths to children with special needs is resulting in the design of new activities capable of bringing out these children's mathematical competence. In this first phase of the project, the activities pay special attention to basic geometrical concepts and their relationships, developing their performance in simple tasks such as drawing a straight line or a circle or comparing objects.

Implications

The main goal of the project is to make some significant contribution to the improvement of the mathematics training for future teachers, without forgetting the updating of in-service professionals, providing them with practical didactical resources which give them a new way of viewing maths while providing both elementary maths contents and also the point of view of children on these contents. Every workshop virtual box will be uploaded on Erasmus + Project Results Platform in order to be downloaded free; it will include materials and detailed instructions regarding their use with groups of prospective or in-service teachers.

At the moment, we are testing several materials in formation workshops addressed to in-service teachers or in mathematical workshops especially designed for children.

At the end of the project, we envisage making several dissemination events to divulge the results that have been obtained.

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